

JULY 1963

BIOLOGICAL EVALUATION OF SOUTHERN PINE BEETLE IN SOUTHEAST TEXAS

by

D. L. Williamson and D. E. Ketcham

INTRODUCTION

The current southern pine beetle epidemic in southeast Texas was discovered near Honey Island, Texas, in January 1957. Populations continued to increase, and a cooperative control project was begun in 1958. Since that time, annual reports recording the history of the epidemic have been issued by the Project Coordinator of the Texas Forest Service (1, 2, 3, 4). In March 1962, a biological evaluation was made jointly by entomologists of the Texas Forest Service; Forest Insect and Disease Control Branch, U. S. Forest Service; and the Southern Forest Experiment Station (5).

The current evaluation was made jointly by the Forest Pest Control Section, Texas Forest Service, and the Forest Insect and Disease Control Branch, Division of State and Private Forestry, U. S. Forest Service, during the first half of 1963. Additional information from population studies conducted in the epidemic area by R. C. Thatcher, Division of Forest Insect Research, Southern Forest Experiment Station, was also utilized.

This evaluation showed that intensified control efforts - along with adverse environmental factors, increased activity by parasites and predators, and competition from other bark beetles and woodborers - have held southern pine beetle populations at a level lower than in previous years of the current epidemic. However, due to their high biotic potential and wide distribution, populations could explode within a very short period if conditions become favorable. Therefore, population trends must be followed closely and control efforts continued in accordance with control procedures recommended by the Texas Forest Service.

TECHNICAL INFORMATION

Causal agent.--The southern pine beetle, Dendroctonus frontalis Zimmerman.

Host trees attacked.--The primary hosts in this area are loblolly pine, Pinus taeda L.; shortleaf pine, Pinus echinata Mill.; and occasionally longleaf pine, Pinus palustris Miller.

Type of damage.--Damage caused by the southern pine beetle is tree mortality resulting from adult feeding and the construction of egg

predators mite
Ips
wood borers
rain

Cambium moisture
temperature

Mite population directly correlated to dry conditions.
the drier the more mites.
wood borers attack
at same time as spruce
therefore compete
for food.

galleries in the cambial region of the host, thus girdling the tree. Blue staining fungi, Ceratocystis spp., are introduced by the causal agent, speed the rate of kill, and reduce the salvage value of the host.

Biological data.--In his population studies of southern pine beetle in the epidemic area, Thatcher collected 1-foot-long sample bolts at log intervals (usually 17-18, 34-35, 51-52 feet, etc. above stump) from intermediate, codominant, or dominant infested trees at biweekly periods. Monthly data for 1963 through May indicated that the ratios of emerging brood to parent adults are less than half those for a similar period in 1962 (table 1). Preliminary data obtained from samples collected from the more active southern pine beetle spots in June 1963 show up to 110 attacks and 1 thousand pupae and prepupae per square foot of bark. The average number of attacks per square foot of bark for the period from January through May ranged from 15 to 52 (table 2).

may be only
300 or 400
will average

TABLE 1.--Comparative mean ratios of increase by months for southern pine beetle in 1962 and 1963.

Month	1962	1963
January	2.16:1	0.70:1
February	2.20:1	3.40:1 ^{1/}
March	2.78:1	1.53:1
April	2.79:1	1.52:1
May	2.68:1	1.00:1

^{1/} Data based on samples from a single tree.

TABLE 2.--Mean number of attacks per square foot of bark per month in 1963.

Month	Number of attacks
January	32
February	15
March	52
April	29
May	26
June	144

The average heights of attack were up to 52 feet in January, February, and April; 69 feet in March; and 35 feet in May. The remainder of the trees was usually occupied by Ips spp.

The numbers of parasites and predators - especially clerids, ostomids, braconid wasps, and mites - have been high throughout the epidemic area. The effectiveness of these groups in reducing southern pine beetle populations has not been determined.

The numbers of woodborers have also been high in the infested trees. Attacks by these insects have followed immediately behind those of southern pine beetle. Along with the normal complex of associated, secondary insects, woodborers have been competing heavily with the southern pine beetle for food.

Environmental factors.--Much of the area currently infested with southern pine beetle has a shallow, silt-loam topsoil with a heavy clay subsoil. These areas can become very dry during periods of deficient rainfall and usually flood during periods of heavy rainfall due to poor internal and external drainage. Soils in other parts of the area are sandier with adequate internal and external drainage.

According to U. S. Weather Bureau records at Beaumont, Texas, rainfall has been below normal for the first 4 months of 1963 (table 3). This trend continued through May, and the amount of rainfall increased considerably in June.

The average monthly temperatures at Beaumont were also below the long-term mean for January and February and above the long-term mean in March and April (table 4). Temperatures during May and June were extremely high.

TABLE 3. Mean precipitation (inches) by months at Beaumont, Texas.

Month	1931-1960 Average	1963
January	4.43	4.07
February	4.50	4.02
March	3.23	.64
April	4.44	1.18
May	5.05	<u>1/</u>
June	4.35	--

1/ Data for May and June not available at the time of this evaluation.

TABLE 4.--Mean temperatures (degrees Fahrenheit) by months at Beaumont, Texas.

Month	1931-1960 Average	1963
January	54.3	46.3
February	56.9	50.6
March	61.8	62.6
April	69.3	73.0
May	76.5	<u>1/</u>
June	82.7	--

1/ Data for May and June not available at the time of this evaluation.

Location and intensity of outbreak.--Over 2 million acres in Orange, Hardin, Liberty, Tyler, Polk, and San Jacinto Counties are currently infested in southeast Texas (figure 1). Harris

Operations recorder surveys of the infested area were made by the Forest Insect and Disease Control Branch, U. S. Forest Service, in cooperation with the Texas Forest Service during October and November 1962, January 1963, and late June 1963. These surveys were designed, conducted, and analyzed in accordance with "Operations Recorder Survey Plan for Pine Bark Beetles" (6).

During the October-November survey, approximately 83 red or fading trees per thousand acres were observed. Approximately 2.8 of these contained active southern pine beetle broods. A high percentage of the remaining trees was infested with Ips spp. The number of red and fading trees decreased to approximately 5 per thousand acres during the January 1963 survey. The number of southern pine beetle infested trees remained nearly constant at 2.1 per thousand acres. In the June survey, the number of reds and faders had increased to over 12 per thousand acres. The number of trees infested with southern pine beetle increased to about 8 per thousand acres. These results are summarized in table 5.

DISCUSSION

For the first time since the current epidemic began, the total area of infestation has decreased instead of increased. In 1957, the year that the first infested trees were located, only an estimated 200 acres were involved. The infested area increased in size through 1962 to a high of 4.5 million acres. In June 1963 the area infested was estimated at 2 million acres. This trend is illustrated in table 6.

Brood survival as indicated in table 1 has also decreased during the first 5 months in 1963, a condition that has only occurred during late summer in previous years. Although the direct effects are difficult to measure, the high populations of parasites and predators have undoubtedly contributed to this decrease. Interspecific competition for available food with Ips, woodborers, and other secondary insects has adversely affected southern pine beetle brood survival. Low rainfall has favored a buildup of Ips populations. The reduced moisture content in the cambial region of the trees caused by the lack of adequate rainfall has also apparently created a condition adverse to the development of southern pine beetle larvae. The dry condition has favored the control operations in that all areas have remained accessible. The low temperatures during the first 2 months of the year (table 4) slowed the development of the southern pine beetle; only 2.5 generations have developed in the first 6 months of 1963 as compared to 4 complete generations in the same period in 1962. All of these factors have worked together to reduce the rate of population increase.

Map will be revised to ~~show~~ show
infested area.

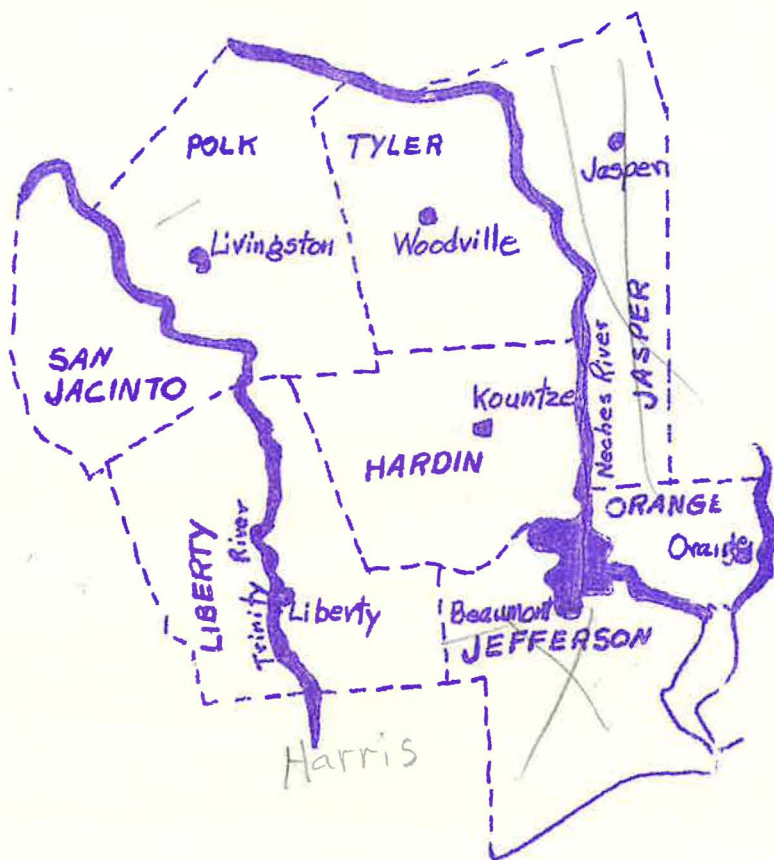


Figure 1. Location of southern pine beetle endemic area in southeast Texas.

TABLE 5.--Results of operations recorder surveys over the epidemic area.^{1/}

	October-November 1962	January 1963	June 1963
Number sampling units	21	31	34
Number spots per thousand acres	55 ± 15.5	4.6 ± 1.3	6.5 ± .80
Number reds and faders per thousand acres	83 ± 20	4.9 ± 1.4	12.3 ± 2.5
Number infested trees per thousand acres	2.8 ± 1.9	2.1 ± .98	8.0 ± 4.9

29% of
infested
trees located
on 5% of spots

^{1/} Confidence limits of 90 percent were used to determine confidence bands.

90%
Confident limit

77.00 ^{5.60}
52.0 29.69%
25.00
27.00
1.600
15.60
15.00
154

on 1 1/2% survey 260 spots picked up
77 spots ground checked about 15 had
S. pine beetles.
5 mi E. Hull
Orange Co.
-5b-

177
20% of spots had active beetles.

TABLE 6.--Area infested by southern pine beetle in southeast Texas by year.

Year	Acreage
1957	200
1958	60,000
1959	200,000
1960	200,000
1961	600,000
1962	4,500,000
1963	2,000,000

Concentrated populations of southern pine beetles in local areas throughout the epidemic area constitute a source which would allow a very rapid buildup under favorable conditions. Observations of infestations in these areas revealed heavy southern pine beetle broods in infested trees with high numbers of new attacks on adjacent trees. Recent rainfall throughout the epidemic area will probably favor a decrease in Ips populations which heretofore have successfully competed with southern pine beetles. Also, the change in moisture conditions could possibly favor southern pine beetle development.

Although current infestations in the epidemic area have remained small as compared to those in 1962, a sufficiently high population still remains to provide a source which could reinfest the entire epidemic area in a relatively short period of time.

IMPACT OF CONTROL ON OTHER RESOURCES

Due to the direct application of a 0.5-percent solution of BHC in diesel oil to the infested portion of the tree, no adverse effects on other resources are anticipated, provided that the recommended control procedure is followed.

RECOMMENDATIONS

1. Full-scale control operations, in accordance with control procedures recommended by the Texas Forest Service, should be continued until all known infestations are controlled.

2. Aerial detection and surveillance flights should be continued at 2-week intervals.
3. Population trends should be determined at regular intervals to keep abreast of the status of the epidemic.

REFERENCES

1. Green, A. E. 1959. Observations During the 1958 Epidemic of Southern Pine Beetle. Unpublished report, Texas Forest Service, District 4, Woodville, Texas.
2. Green, A. E. 1961. Observations During the 1959 and 1960 Epidemic of the Southern Pine Beetle. Unpublished report, Texas Forest Service, District 4, Woodville, Texas.
3. Williamson, Leroy. 1962. Observations on the 1961 Southern Pine Beetle Epidemic. Unpublished report, Texas Forest Service, District 4, Woodville, Texas.
4. Williamson, Leroy. 1963. Observations on the 1962 East Texas Southern Pine Beetle Epidemic. Unpublished report, Texas Forest Service, District 4, Woodville, Texas.
5. Williamson, Leroy, Ketcham, D. E., and Bennett, Wm. H. 1962. Biological Evaluation of the Southern Pine Beetle Epidemic in Southeastern Texas. Unpublished report, Forest Insect and Disease Control Branch, U. S. Forest Service, Alexandria, Louisiana.
6. Ketcham, D. E. 1963. Operations Recorder Survey Plan for Pine Bark Beetles. Proceedings of the Second Annual Forest Insect and Disease Control Work Conference, Region 8, U. S. Forest Service, Atlanta, Georgia. (Unpublished.)